Nuclear Power Expansion and the Nuclear Fuel Cycle

George E. Dials

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Several prominent political leaders have recently suggested that the U.S. should greatly expand it nuclear power production capabilities. In a speech in Oak Ridge on May 27, 2009, Senator Lamar Alexander challenged the nation to build 100 new nuclear power plants in the next 20 years to meet existing and growing electricity demands and enable the reduction of global warming emissions from existing and projected fossil energy power plants. President Obama's selected "Energy Team", including Dr. Stephen Chu as the Secretary of Energy, might be inclined to approach our energy needs with a strong focus on clean energy production but given encouragement from Senator Alexander and others, it could include some begrudged support for the role nuclear power might play. As reported in a 2005 interview in the UC Berkley News, Dr. Chu "expressed support for the expanded use of nuclear power and for a closed fuel cycle".

Given that perspective, Dr. Chu and President Obama might then favor a "rationalized" nuclear fuel cycle such as that I have previously proposed in a national nuclear conference in 2005. The key elements of the approach then and, as modified to match today's situation, remain to minimize risk to the public and the environment, maximize resource utilization, minimize volumes of nuclear waste for disposal, retain maximum fuel cycle flexibility, and contribute substantially to U.S. energy independence , while helping achieve a concomitant reduction in the production of global warming emissions.

Today nuclear power contributes only about 20 percent of U. S. electricity demand as we confront yet another "energy crisis". Over 65 percent of our oil needs come from foreign sources, and U. S. troops are deployed in the most unstable sector of the world to assure our access to those sources of oil. In addition, we confront the postulated specter of global warning caused by fossil fuel use, while continuing to impede the expansion of nuclear power that is needed to sustain our economy and way of life; this impedance is based largely on the premise that there is no solution for the safe management and/or disposal of used nuclear fuel (UNF) and high level radioactive waste (HLW). However, this premise and thus who support it ignores the fact that UNF has been safely store at several dozen separate sites (including the nuclear power plants themselves) around the country for over two decades.

How then can we move forward to achieve the objectives suggested by Senator Alexander to nearly double the available nuclear power generation of electricity in 20 years thus supporting energy independence and, green energy production and global warming emissions reductions. I am suggesting that to do so requires that we **rationalize** the nuclear fuel cycle. In Webster's Dictionary, one can find too frequently applied definitions of rationalize: 1) to apply the principles of scientific management for a desired result, or 2) to provide plausible but untrue reasons for past and ongoing conduct. Any reader who has teenage children is certainly familiar with the applications of definition number 2, and I find that that seems to be the definition that has most recently (in the past two decades) been applied in our national efforts to formulate and implement a national energy policy. What then can we do to redress this situation by applying my preferred definition (1 above) to **rationalize** the nuclear fuel cycle in order to contribute to the growth of nuclear power and meet our defined national energy goals?

First, we must recognize that disposal of once-through UNF is counter to establishing a complete, closed nuclear fuel cycle which results in the efficient utilization of the energy from low-enriched uranium fueled nuclear power plants; thus, we must re-establish a commercial nuclear fuel reprocessing/recycling enterprise to sustain our nuclear power capabilities. The goals for national energy security must be supported by the focused expansion of nuclear power supplied electricity, which is dependent upon this closed nuclear fuel cycle. This fuel cycle must of necessity include storage, reprocessing and volume-reduced HLW disposal.

To optimize what has been learned at the numerous individual UNF storage sites around the country and to enhace efficiency, cost-effectiness and security of the storage process, the DOE should identify and establish regional (2 or 3) national monitored retrievable storage MRS sites

for the UNF until reprocessing facilities and ultimately a HLW repository is developed. In addition, the DOE should take title to UNF from the utilities much earlier than 2020, which would reduce the utilities' damage claims. To minimize proliferation and terrorist threats/concerns and the environmental impact of an accidental release of radionuclides/isotopes, the UNF should be stored in the **MRS**. Successful MRS facility designs have been implemented in Finland and Sweden during the past 20 years.

As demonstrated at the WIPP nuclear waste disposal site in New Mexico site and in Germany, rock salt is a preferred and very suitable medium for safe containment and isolation of nuclear waste. However, ashas been demonstrated in both domestic and international projects, local acceptance may be the deciding factor. Hence, local acceptance should be verified before a site is selected. Furthermore, to counter the publics distrust of federal government solutions to energy and environmental problems, establish a commercial/private organization (TVA-like) with strong utility representation for the development of the nation's first HLW repository by the year 2025. An expansion of the mission at the current WIPP facility and/or a WIPP#2 should be an option considered by the commercial entity.

The approach to be taken to resolve the policy or socio-political failures to address the nuclear energy supply problem requires a holistic and technically achievable (rationalized) nuclear fuel cycle. That **"rationalized"** approach would include a timely commitment to construct a used nuclear fuel reprocessing/recycling facility to recover the remaining energy in the fuel and volume reduce and vitrify (solidify) the remaining HLW constituents. This vitrified material could ultimately be shipped to the exist long-

lived radioactive waste disposal facility in a bedded salt formation at a site to be selected, with public involvement and approval, and developed by 2025. To ready the UNF for reprocessing, it could be stored for a defined number of years to reduce heat, loading and radioactivity levels at a **monitored retrievable storage** facility.

The technologies are available, the sites are characterized and the licensing processes are well defined. We can accomplish this approach in the next fifteen years.